

IN THE CLAIMS:

Claims 1-4, 8, 10-13 and 16 have been amended herein. All of pending claims 1-6 and 8-16 are presented in clean form below, pursuant to 37 C.F.R. §§ 1.121(c)(1)(i) and 1.121(c)(3). Please enter these claims as amended.

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1. (Three Times Amended) A pickup tool for placing preformed solder balls on a substrate, comprising:
a tool body controllably movable in multiple axes and rotatable about an axis;
a plurality of ball seats formed in said body for said preformed solder balls, said plurality of ball seats each having an aperture therein;
passageways leading from said aperture to a vacuum source and to a pressurized gas source;
a first valve apparatus for controlling separately and independently a vacuum to said plurality of ball seats, said vacuum retaining said solder balls on said plurality of ball seats; and
a second valve apparatus for controlling separately and independently a gas under pressure to said plurality of ball seats, said gas under pressure for releasing said solder balls from said plurality of ball seats.
2. (Amended) The pickup tool of claim 1, wherein said vacuum holds said solder balls in said plurality of ball seats and said pressurized gas ejects said solder balls from said plurality of ball seats.
3. (Amended) The pickup tool of claim 1, wherein said vacuum holds said solder balls in said plurality of ball seats and said pressurized gas ejects said solder balls from said plurality of ball seats to a plurality of bond pads on said substrate.
4. (Amended) The pickup tool of claim 1, further comprising:
a controllable ball dispenser supplying said solder balls to said pickup tool, comprising:
a ramp for feeding said solder balls to said plurality of ball seats, said ramp having an upper end and a lower end;

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a controllable valve at the lower end of said ramp for releasing a single solder ball of said solder balls on demand to said plurality of ball seats using a vacuum applied to said plurality of ball seats; and
a reservoir providing a supply of said solder balls to said ramp.

5. The pickup tool of claim 4, further comprising:
a gas inlet in said reservoir, said gas inlet connected to a source of pressurized gas for providing gas flow through said solder balls to provide a non-interrupted flow of said solder balls through said ramp.

6. The pickup tool of claim 4, wherein said ramp holds a series of solder balls having a diameter in the range of about 0.01 mm to about 0.15 mm.

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8. (Three Times Amended) A pickup tool for placing a plurality of solder balls on ball-grid-array bond pads of a substrate, said pickup tool comprising:
a pickup tool body with a hollow chamber therein;
a lower plate having a plurality of seats therein for retaining a solder ball in each seat, said plurality of seats corresponding to an inverted configuration of an array of bond pads on a substrate;
a plurality of passageways leading from each said seat to said hollow chamber;
a passageway leading from said chamber to a vacuum source;
a passageway leading from said chamber to a pressurized gas;
a first controllable valve apparatus for controlling opening and closing said vacuum passageway;
and
a second controllable valve apparatus for controlling opening and closing said pressurized gas passageway.

9. (Previously Amended) The pickup tool of claim 8, further comprising:
a heater to heat said pickup tool to a temperature to bond said solder balls to said bond pads of
said substrate.

10. (Three Times Amended) A pickup tool for placing preformed solder balls on a
substrate, comprising:

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a tool body controllably movable in multiple axes and rotatable about an axis;
a plurality of ball seats formed in said tool body for a plurality of solder balls, each ball seat of
said plurality of ball seats having an aperture therein;
passageways leading from said aperture to a vacuum source and to a pressurized gas;
a first controllable valve apparatus controlling the vacuum, said vacuum retaining said plurality
of solder balls in said plurality of ball seats; and
a second controllable valve apparatus controlling the pressurized gas to said plurality of ball
seats, said pressurized gas for releasing said plurality of solder balls from said ball seat.

11. (Amended) The pickup tool of claim 10, wherein said vacuum holds said
plurality of solder balls in said plurality of ball seats and said pressurized gas ejects said plurality
of solder balls from said plurality of ball seats to a bond pad on a substrate.

12. (Twice Amended) A pickup tool for placing preformed solder balls on a
substrate, comprising:
a tool body controllably movable in multiple axes and rotatable about an axis;
a plurality of ball seats formed in said tool body for a plurality of solder balls, each ball seat of
said plurality of ball seats having an aperture therein;
passageways leading from said aperture to a vacuum source and to a pressurized gas; and
controllable valve apparatus controlling the vacuum and the pressurized gas to said plurality of
ball seats, said vacuum retaining said plurality of solder balls in each said plurality of ball
seats and said pressurized gas releasing said plurality of solder balls from said plurality of
ball seats;

a solder ball dispenser supplying said plurality of solder balls to said pickup tool, comprising:
a tubular ramp for feeding said plurality of solder balls to said plurality of ball seats, said ramp
having an upper end and a lower end;
a controllable valve at the lower end of said ramp for releasing a single solder ball of said
plurality of solder balls to a ball seat of said plurality of ball seats while a vacuum is
applied to said plurality of ball seats;
a reservoir for providing a supply of solder balls to move downwardly through said ramp.

13. (Amended) The pickup tool of claim 12, further comprising:
a gas inlet in said reservoir, said gas inlet connected to said pressurized gas providing gas flow
through said plurality of solder balls providing a non-interrupted flow of said plurality of
solder balls through said ramp.

14. The pickup tool of claim 12, wherein said ramp holds solder balls having a
diameter of about 0.01 mm to about 0.15 mm.

15. (Previously Twice Amended) A pickup tool for placing a plurality of solder balls
on ball-grid-array bond pads of a substrate, said pickup tool comprising:
a pickup tool body with a hollow chamber therein;
a lower plate having a plurality of seats therein for attracting and retaining a solder ball in each
seat, said plurality of seats corresponding to an inverted array of bond pads on a substrate;
passageways leading from each said seat of said plurality of seats to said hollow chamber;
a passageway leading from said chamber to a vacuum source;
a passageway leading from said chamber to a pressurized gas;
a first controllable valve apparatus for controlling opening and closing said vacuum passageway;
and
a second controllable valve apparatus for controlling opening and closing said pressurized gas
passageway.

16. (Amended) The pickup tool of claim 15, further comprising:
8 a heater to heat said plurality of solder balls to a temperature to bond to said bond pads on said substrate.